# Site Characterization and Monitoring Technologies Technology Profile

## ◆ On-Site Analysis of VOCs in Water ◆

## Technology Summary

On-site analysis of volatile organic compounds (VOC) in groundwater offers the field investigator reliable, short-turnaround results in contrast to off-site laboratory analyses that often require weeks until results are available. Technologies for this type of application undergoing verification testing can be grouped into two general categories; namely, gas chromatographs and spectrophotometers. Field-portable gas chromatographic systems can be equipped with a variety of detectors including electron capture, photoionization and mass ion detectors. These systems can be used to analyze groundwater samples containing multiple unknown VOC compounds. In many cases samples with unknown VOC composition can be fully identified and quantified in the field. Spectrophotometric instruments incorporate very sensitive acoustic detectors and require that the sample's VOC constituents be known. Spectrophotometers are also less versatile than chromatographic systems since they can only be used for a subset of VOC compounds. Both technologies require that the VOC compounds of interest be extracted from groundwater either by static headspace equilibrium or purge-and trap techniques. Static headspace methods offer simplicity whereas purge-and-trap methods are more complex and more sensitive. A verification test was carried out with a variety of field-portable technologies to determine their performance characteristics for the measurement of VOCs in water. The participating vendors are listed below.

| Technology | Vendor | Contact | Address and Web Information |
|---|---|---|---|
| **Model 4110 Vapor Detector** (gas chromatograph) | **Electronic Sensor Technology** | **Gary Watson** 805-480-1994 watson@estcal.com | 1077 Business Center Circle Newbury Park, CA 91320 www.estcal.com |
| **HAPSITE** (gas chromatograph/ mass spectrometer) | **Inficon Inc.** | **Bill Worthington** 315-434-1100 reachus@inficon.com | Two Technology Place East Syracuse, NY 13057 www.inficon.com |
| **Type 1312 Multi-Gas Monitor** (photoacoustic spectrometer) | **Innova AirTech Instruments** | **Hal Peper** 714-974-5560 sgt@analyzer.com | 1238 West Grove Avenue Orange, CA 92665 www.innova.dk |
| **Voyager** (gas chromatograph) | **Perkin-Elmer** | **Peter Ebersold** 800-762-4000 info@perkin-elmer.com | 50 Danbury Road Wilton, CT 06897 www.perkin-elmer.com |
| **Scentograph Plus II** (gas chromatograph) | **Sentex Systems Inc.** | **Amos Linenberg** 201-945-3694 sentex@sentexinc.com | 533 Broad Street Ridgefield, NJ 07657 www.sentexinc.com |


*Model 4100*


*HAPSITE*


*Type 1312*


*Voyager*


*Scentograph*

## General Market Information

### How much do field-portable analytical technologies for detection of VOCs in water cost?

Capital costs for field-portable equipment to analyze water samples range from $20,000 to $90,000 depending upon the type of instrument and accessories selected. Some of the technologies also require expendable supplies such as calibration mixtures, carrier gases, and sample vials.

### Who would use or purchase such technologies?

Field portable systems for the analysis of VOCs in water are used by consulting engineers, commercial laboratories, and state or federal regulators during site characterization or routine monitoring of contaminated groundwater at environmental sites. These instruments would also be useful in combination with other screening devices for Brownfields investigations.

### What is the advantage of field-portable technologies over conventional laboratory analyses?

The use of field portable analytical systems can provide quick-turnaround data in the field, which can be used to guide a site investigation in progress. Lengthy wait times for sample turnaround through fixed laboratories are avoided. Cost savings may also be realized for field portable analytical systems used in routine groundwater monitoring programs by avoidance of time-consuming chain-of-custody and transportation of samples to the laboratory since the analyses can be done at the wellhead by the groundwater sampling crew.

## *Verification Test Description*

The performance of these five instrument systems was verified using a combination of quality control samples and actual groundwater samples from two sites with contaminated groundwater. Samples containing over 20 chlorinated and non-chlorinated VOCs were prepared in concentrations ranging from 10 to 1000 ug/L. Analysis results were used to determine instrument accuracy for each of the participating vendors. Replicate sample analyses were also done so that instrument precision could be determined. Comparability of technology results with reference analyses was done using conventional fixed laboratory analyses via SW 846 Method 8260 (Purge-and-trap GC/MS) of sample splits. The test was carried out under a variety of field conditions at the Department of Energy Savannah River site in South Carolina as well as at McClellan Air Force Base near Sacramento, CA. The major groundwater contaminants at both sites were trichloroethene and tetrachloroethene. A total of 165 performance evaluation and groundwater samples were analyzed by each of the technologies at both sites. Logistical aspects of technology deployment, such as sample throughput, ease of use, operator training requirements, and required ancillary equipment were also observed and documented during the tests. The verification test plan and summary performance reports can be found at http://www.epa.gov/etv/library.htm

## *Technology Performance Factors*

The results of the verification tests can be downloaded from the ETV web site at **www.epa.gov/etv.**
The following is a list of performance factors, which are discussed in the verification reports.

- ✓ Precision
- ✓ Accuracy
- ✓ Sample Throughput
- ✓ Analytical Versatility
- ✓ Comparability with SW-846 Reference Method
- ✓ Data Completeness
- ✓ Performance at Regulatory Limits
- ✓ Ease of Use
- ✓ Deployment Logistics
- ✓ Cost

## *For More Information*

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